

SPECIFICATION

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[FULLY AUTOMATIC AND ENERGY-EFFICIENT DEIONIZER]

Cross Reference to Related Applications

Po This application is a continuation-in-part of U.S. patent application Ser. No. 09/948,852, filed July 9, 2001, ^{now US Patent 6,462,935} and entitled "Replaceable Flow-Through Capacitors for Removing Charged Species from Liquids". The present application is also a continuation-in-part of U.S. patent application Ser. No. 10/109,825, filed March 27, 2002, ^{now U.S. Patent 6,580,598} and entitled "Deionizers with Energy Recovery". Both prior applications are incorporated herein by reference.

Background of Invention

[0001] Field of Invention

[0002] This invention relates to an energy management and other automatic control systems employed in a deionizer system that can remove charged species from liquids automatically and continuously with recovery of the process energy. More specifically, this invention relates to ion removal systems using capacitive deionization (CDI) on a number of flow-through capacitors (FTCs) in conjunction with supercapacitors, ultracapacitors, or electric double layer capacitors as the energy-storage device for storing the electrical energy that is reclaimed during the regeneration of FTCs.

[0003] Description of Related Art

[0004] There are numerous pollutants of inorganic, organic, or biological nature in the contaminated liquids and waters. Many methodologies and techniques can be used to decontaminate the impure fluids, nevertheless, none of the methods is universal. Among the pollutants, charged species or ions are probably the most frequently occurring source of contamination. This is due to that the contaminants often dissolve